Metal Tube Floater Flow Meter

Model：PT124B-504

1, Description

Metal tube floater flow meter (metal tube rotor flow meter) is a variable area flow measurement meter commonly used in industrial automation process control. It is featured by small size, large detection range and easy operation, it can be used to measure the flow of liquids, gases and steam, and particularly suitable for the measurement of low flow speed and small flow rate.It is widely used in the industrial of petrochemicals, iron and steel, electric power, metallurgy, light industry, food, pharmaceuticals and water treatment.

2, Measurement principle

Metal tube floater flow meter is mainly composed of two parts: sensor and indicator. The sensor is mainly composed of connection flange, measurement conical tube, floater and upper and lower guiders; the indicator is mainly composed of enclosure, magnetic drive system, dial and electric remote transmission system.In the vertical conical measurement tube, there is a measuring part-floater (Fig. 1) that can move up and down, when the fluid passes through the conical tube from bottom to top, the floater is moved upward along the conical tube by the force of the fluid. When the flow rate of the fluid increases, the displacement of the floater increases; conversely, when the flow rate of the fluid decreases, the displacement of the floater decreases. That is to say, the fluid flow rate determines the position of the floater in the measurement tube, thus determines the size of the annular area between the floater and conical tube. When the flow rate of the fluid is maintained at a constant flow rate Q, the floater is also in a state of dynamic equilibrium and staying at a position h in the conical tube, at which point the annular area between the floater and the conical tube remains constant. The floater is affected by three forces: the gravity G of the floater, the buoyancy F of the floater, and the force P applied to the floater by the fluid, these three forces achieve balance (Fig. 1). According to the Bernoulli equation, the principle of force balance and the law of fluid continuity in the hydrodynamic, the instantaneous fluid flow rate passing through the annular area at the time can be calculated; therefore, the metal tube floater flow meter uses the principle of measuring the flow rate using variable areas.

Inside the floater, a high-performance permanent magnet is embedded, when the floater is in the equilibrium position, a uniform and stable magnetic field is formed around the floater. A magnetic sensor is installed outside the conical tube, so that the linear displacement of the floater in the measurement tube can be transmitted to the indicator through a non-contact way, after detection and processing, it is finally displayed on the indicator dial or output corresponding standard 4-20mA current signal.

3, Function and features

Suitable for small-diameter and low-flow medium flow measurement

Reliable operation, low maintenance and long service life

Low requirement for straight pipe section

Wide range ratio 10:1

Dual-line LCD display, local instantaneous/accumulated flow display

Keyboard on indicator to facilitate setting

Full metal structure, suitable for high temperature, high pressure and strong corrosive media

Non-contact magnetic coupling drive

Can be used in flammable and explosive dangerous occasions

Optional DC power supply or battery power supply

With data recovery, data backup and power-down protection functions

Multi-parameter calibration function

4, Technical Parameters

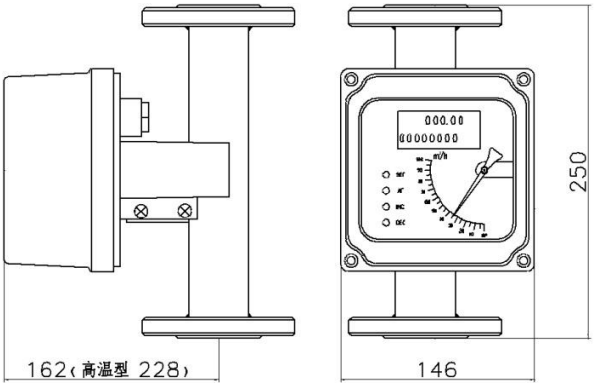
Parameter	Value
Diameter	DN15, DN25, DN50, DN80, DN100, DN150 (Please consult with the manufacturer for other diameters)
Flow Range	1.0～150000l/h Gas: 0.05～3000m3/h (For the flow rate range, please refer to page 11)
Range ratio	10:1, 20:1 (special)
Accuracy	Grade 1.5, Grade 1.0 (Special)
Pressure rating	DN15, DN25, DN50: 4.0MPa (maximum 20MPa) DN80, DN100, DN150: 1.6MPa (Maximum: DN80: 10MPa; DN100: 6.4MPa; DN150: 4.0MPa)
Medium temperature standard	-30℃～+120℃, high temperature: 120℃～350℃
Power Supply	24VDC (12~36VDC), 220VAC
Output signal	4 ~ 20mADC (two-wire system), HART protocol can be added
Output load	500Ω(at 24V power supply)
Ambient temperature local type	-40℃～120℃ Remote type: -30℃～60℃
Storage conditions Temperature	-40℃～85℃ Humidity: ≤ 85%
Flange standard	GB/T9119-2000, user can specify (other connection forms can be negotiated with the manufacturer)
Cable Interface	M20×1.5, 1/2 NPT
Enclosure Protection	IP65
Explosion Proof	Marking Intrinsically Safe, Ex ia IICT6, Flameproof: Ex d IICT6
Pressure loss	Reference to flow chart for details
Medium viscosity DN15	η<5mPa.s DN25: η <250mPa.s DN50～DN150: η<300mPa.s
Wetted material R1	R1 304, 1Cr18Ni9Ti; R0: 316, 0Cr18Ni12Mo2Ti; RL: 316L, 00Cr17Ni14Mo2Ti; Ti: Titanium; Rp: Teflon lining

5, Flow meter types and dimensions

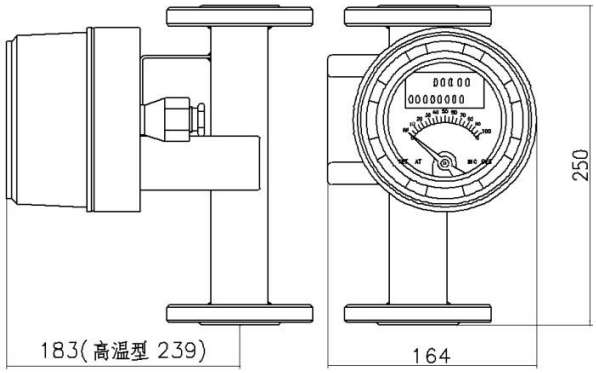
The flow meter consists of measurement tube (sensor) and indicator (electronic converter), different types of measurement tubes and indicators can be selected and assembled into various forms of complete meter to meet the needs of site. Various flow meters types and dimensions, connection flange standards and magnetic filter's installation dimensions are described below.

5.1 Product Classification

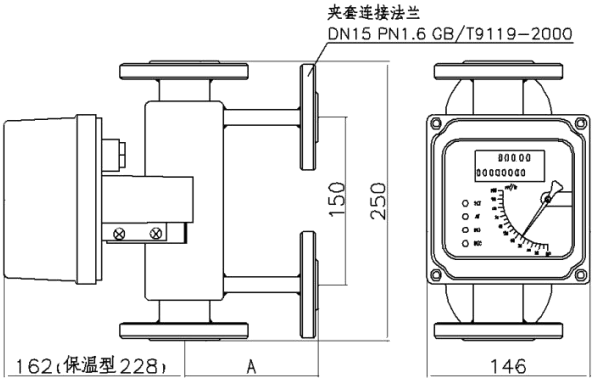
5.1.1, Vertical type



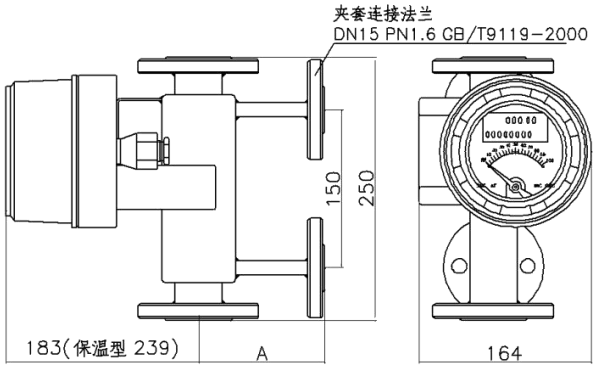
Standard type M1 indicator



Standard type M2 indicator



Cooling jacket type M1 indicator

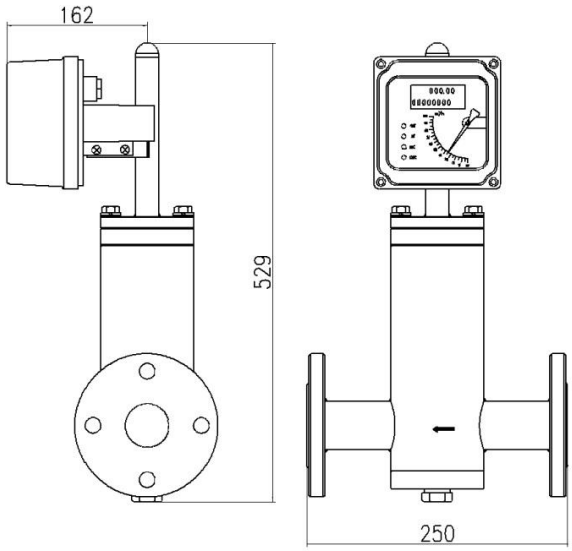


Cooling jacket type M2 indicator

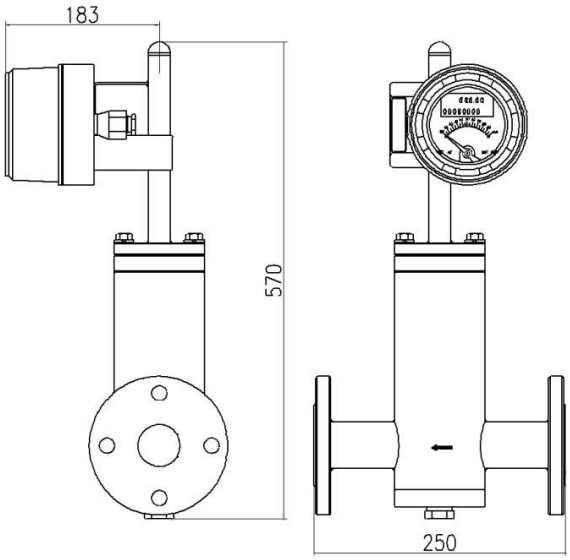
5.1.2, Horizontal type

Diameter	DN15	DN25	DN50	DN80	DN100	DN150	DN200
A	100	120	135	150	160	40	200
Standard type weight (kg)	5.0	6.5	10	16	17	35	50
Jacket type weight (kg)	7.5	9.5	13	19	20	40	55

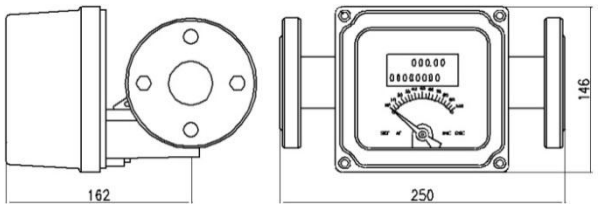
For horizontal installation type flow meters, T-shaped structure is adopted when the diameter is less than DN50 (including DN50); and spring structure is adopted when ＞ DN50.



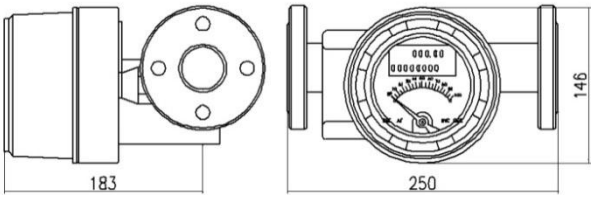
T-shaped structure M1 indicator



T-shaped structure M2 indicator



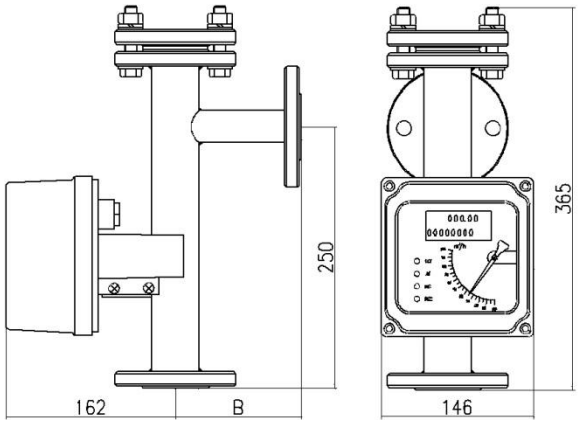
Spring structure M1 indicator



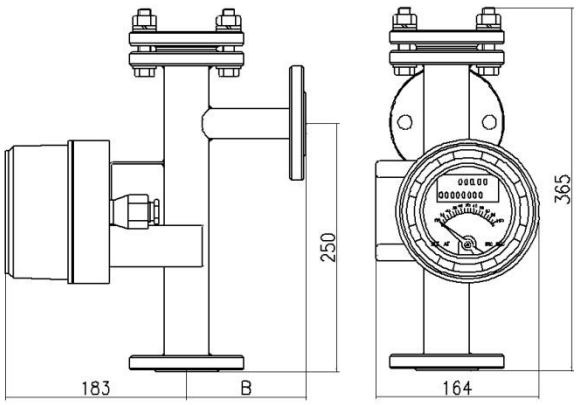
Spring structure M2 indicator

Diameter	DN15	DN25	DN50	DN80	DN100	DN150	DN200
T-shaped structure weight (kg)	6	10	20				
Spring structure weight (kg)				16	17	35	50

5.1.3, Bottom-in and side-out type



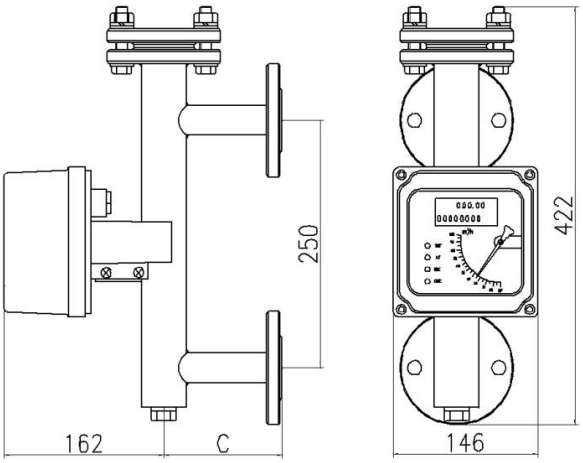
Standard M1 indicator



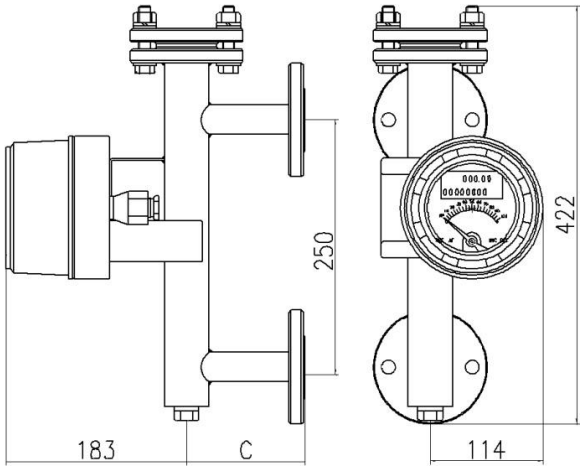
Standard M2 indicator

Diameter	DN15	DN25	DN50	DN80	DN100	DN150	DN200
B	100	120	135	150	160	180	200
Weight kg	6	7	14	24	28	52	60

5.1.4, Side-in and side-out type



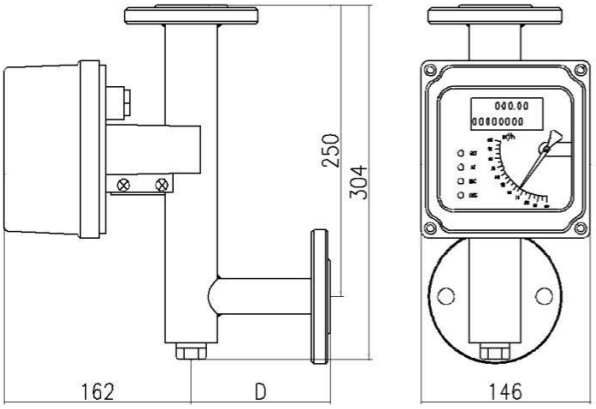
Standard M1 indicator



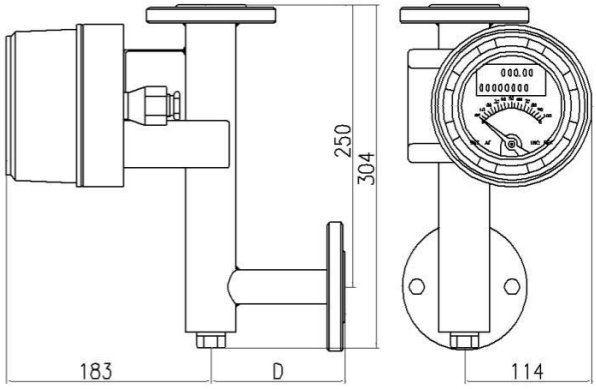
Standard M2 indicator

Diameter	DN15	DN25	DN50	DN80	DN100	DN150	DN200
C	100	120	135	150	160	180	200
Weight kg	5.5	6.5	13	22	26	50	57

5.1.5, Side-in and top-out type



Standard M1 indicator



Standard M2 indicator

Diameter	DN15	DN25	DN50	DN80	DN100	DN150	DN200
D	100	120	135	150	160	180	200
Weight kg	5.5	6.5	10.5	16	17	36	52

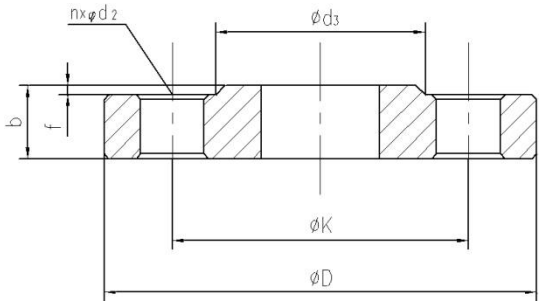
5.2 Flange size

The standard type metal tube floater flow meter adopts the flange standard of GB/T9119-2000, see Figure 16, the specific dimensions are shown in Table 6; other flange standards can be produced according to the requirements of users.

Chinese National Standard Flange (GB/T9119—2000)

DN/PN	D	K	d3	b	f	N	d2
15/4.0	95	65	46	14	2	4	14
25/4.0	115	85	65	16	2	4	14
50/4.0	165	125	99	20	2	4	18
80/1.6	200	160	132	20	2	8	18
100/1.6	220	180	156	22	2	8	18
125/1.6	250	210	184	22	2	8	18
150/1.6	285	240	211	24	2	8	22

Flange Dimensions



American National Standard Flange (ANSI B 16.5 150lb)

DN	D	K	d3	b	f	N	d2
1/2”	88.9	60.5	35.1	11.2	1.6	4	15.7
1”	108.0	79.2	50.8	14.2	1.6	4	15.7
2”	152.4	120.7	91.9	19.1	1.6	4	19.1
3”	190.5	152.4	127.0	23.9	1.6	4	19.1
4”	228.6	190.5	157.2	23.9	1.6	8	19.1
5”	254.0	215.9	185.7	23.9	1.6	8	22.4
6”	279.4	241.3	215.9	25.4	1.6	8	22.4

German National Standard Flange (DIN2501)

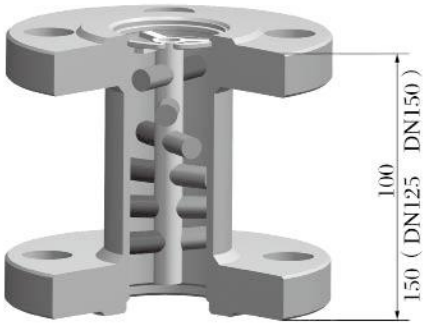
DN/PN	D	K	d3	b	f	n	d2
15/4.0	95	65	46	16	2	4	14
25/4.0	115	85	68	18	2	4	14
50/4.0	165	125	102	20	3	4	18
80/1.6	200	160	138	20	3	8	18
100/1.6	220	180	162	20	3	8	18
125/1.6	250	210	188	22	3	8	18
150/1.6	285	240	218	22	3	8	22

The DIN2501 flange standard is basically equivalent to the following standards and can be used together

Standard	Standard Name	Pressure Rating PN MPa					Standard	Standard Name	Pressure Rating PN MPa
HG20527-1992	Steel pipe flange	0.6	1.0	1.6	2.5	4.0	DIN2527-1992	Flange	0.25～10.0
HG20592-1992	Steel pipe flange	0.6	1.0	1.6	2.5	4.0	DIN2566-1975	Threaded flange	1.0～1.6
HG20592-1997	Steel pipe flange	0.6	1.0	1.6	2.5	4.0	DIN2573-1975	Flat welded flange	0.6～1.0
HGJ44～76-1991	Steel pipe flange	0.6	1.0	1.6	2.5	4.0	DIN2655-1975	Flat welding ring plate loose flange	0.25～4.0
GB112～9123-2000	Steel pipe flange	0.6	1.0	1.6	2.5	4.0	DIN2673-1962	Butt welding ring plate loose flange	1.0

5.3 Magnetic filter

If the media contains ferromagnetic particles, a magnetic filter should be installed at the upstream of the flow meter inlet. For D N100 (included) or smaller, the height is 100mm; for more than DN100, the height is 150mm



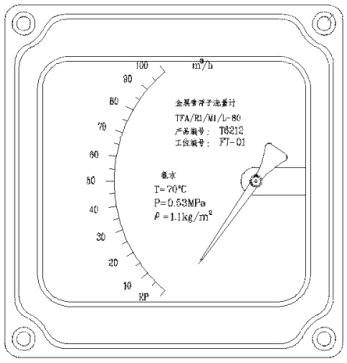
6. Indicator and Limit alarm device

The indicator of the metal tube floater flow meter is the displaying and conversion part of the flow meter; the limit alarm device can realize the flow rate over-limit alarm and is used as the flow switch.

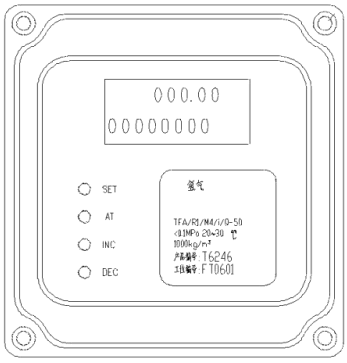
6.1, Selection of Indicator

User can choose the local display type, electric remote type, intrinsically safe explosion proof type, flameproof type or HART protocol type according to the actual needs of the site, the detailed functions of various indicators are shown in the following table.

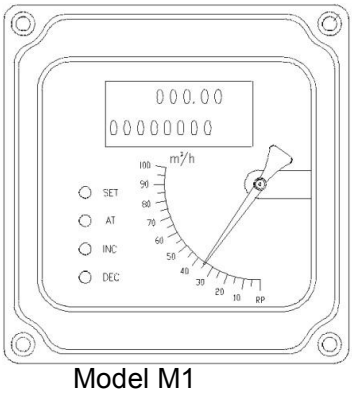
Indicator Type	Function Description of Indicator
Model M0	Local indicator, square enclosure, pointer indication of instantaneous flow rate, no power supply, no 4-20mA remote transmission, optional flow rate alarm device, optional instantaneous flow rate value or percentage value dial.
Model M1	Electric remote transmission, square enclosure, intrinsically safe design, Ex ia IICT6, optional HART protocol function. 24VDC power supply, local pointer indication of instantaneous flow rate, LCD indication of instantaneous and accumulated flow rate, 2-wire 4-20mA output, and panel has 4 keys for viewing and modifying internal parameters.
Model M2	Round enclosure, both local and electric remote transmissions are available. For local type, the pointer indication of instantaneous flow rate, no power supply and no 4-20 mA remote transmission. For remote transmission, flameproof design and optional HART protocol functions. 24VDC power supply, on-site pointer indication of instantaneous flow rate, LCD indication of instantaneous and accumulated flow rate, 2-wire 4-20mA output, and panel has 4 keys for viewing and modifying internal parameters.
Model M3	Square enclosure, both local and electric remote transmissions are available. For local type, the pointer indication of instantaneous flow rate, no power supply and no 4-20 mA remote transmission. For remote transmission, intrinsically safe design, optional HART protocol function. 24VDC power supply, local pointer indication of instantaneous flow rate, LCD indication of instantaneous and accumulated flow rate, 2-wire 4-20mA output.
Model M4	Small round stainless steel enclosure, instantaneous indication of flow rate, no power supply, no 4-20mA remote transmission
Model M5	Large stainless steel enclosure, pointer indication of instantaneous flow rate or LCD indication of instantaneous and accumulated flow rate



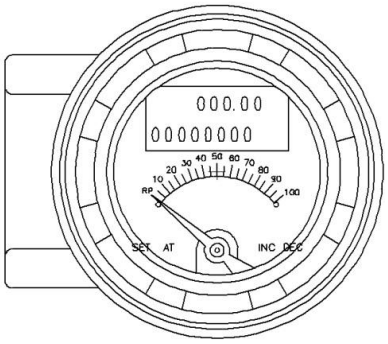
Model M0



Model M3



Model M1



Model M2

6.2, Selection of Alarm Device

The K1 and K2 limit alarm devices are installed in the M1 local indicator, K1 is the lower limit and K2 is the upper limit, the alarm point can be freely set. K1, K2 alarm switch consists of two parts, one part is in the indicator and referred to as TG22. The TG22 is composed of a SJ3.5N sensor and the cutting blade on a rotating shaft. The alarm point can be freely set throughout the entire flow range and indicated on the dial by the positioning pointer. The other part is the external WE77/Ex transistor relay.

The SJ3.5 type sensor is used in conjunction with the transistor relays WE77/Ex-1 and WE77/Ex-2 to achieve the remote transmission of upper and lower limit alarm signals, and has intrinsically safe explosion-proof performance, the explosion-proof mark is Ex ia IICT6; of which WE77/Ex-1 can be provided with a SJ3.5 sensor to achieve the single alarm point control; WE77/Ex-2 can be provided with two SJ3.5 sensors to achieve the control of upper and lower alarm points.

6.2.1 WE77 transistor relay and SJ3.5 sensor's technical parameters are shown in the table below:

Model	WE77/E-1	WE77/E-2	Model	SJ3.5-N	SJ3.5-SN
Power Supply	220VAC,24VDC		Power Supply	8VDC	8VDC
Power consumption	About 3.5VA		Effective area, open	≥ 3mADC	
Working Temperature	-25℃～ +60℃		Effective area, closed	≤ 1mADC	≤ 1mADC
Open circuit voltage	8(13.5)V	8(13.5)V	Self inductance	250μH	100μH
Short Circuit Current	8(31)mA	8(62)mA	Self capacitance	50nF	60nF
Permissible inductance	3(31)mH	1(7.6)mH	Working temperature	-25℃～ +70℃	-40℃～ +100℃
Permissible capacitance	230(609)nF	160(539)nF			

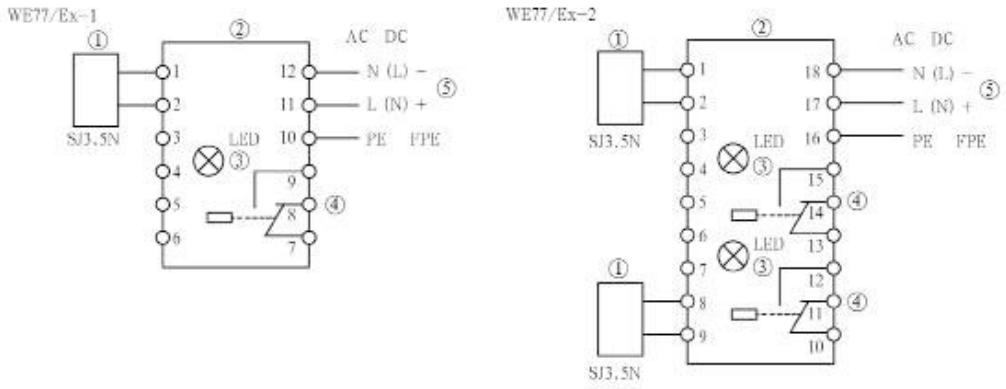
6.2.2 Adjustment and Electrical Connection of WE77 Transistor Relay and SJ3.5 Sensor:

Transistor relays include power supply, transistor rectification amplifiers and output intermediate relays. The WE77/EX-1 and WE77/EX-2 are usually connected to a normally open operating mode, which can be changed to a normally closed working mode or a normally closed working mode with open circuit monitoring by changing the wiring.

Replace the jumper according to the figure below to obtain various working conditions. An LED tube is used to indicate "relay closed".

Model	WE77/E-1	WE77/E-2	Model	SJ3.5-N	SJ3.5-SN
Power supply	220VAC、24VDC		Power supply	8VDC	8VDC
Contact capacity	3A		Effective area, open	≥ 3mADC	
Power Consumption	About 3.5VA		Effective area, closed	≤ 1mADC	≤ 1mADC
Working temperature	-25℃～ +60℃		Self inductance	250μH	100μH
Open circuit voltage	8(13.5)V	8(13.5)V	Self capacitance	50nF	60nF
Short circuit current	8(31)mA	8(62)mA	Working temperature	-25℃～ +70℃	-40℃～ +100℃
Permissible inductance	3(31)mH	1(7.6)mH			
Permissible capacitance	230(609)nF	160(539)nF			

6.2.3 Installation and Dimensions of WE77/Ex Transistor Relay (See the figure below)



① SJ3.5N Sensor
② Isolated conversion amplifier
③ LED light is on when the relay is working
④ Relay output
⑤ Power supply 220V AC

7. Diameter calculation and flow rate table

The flow rate tables listed in this manual are calculated using water and air as the standard medium, therefore, the flow rate of the measured medium on the site must first be converted into the volumetric flow of water or air, and then check the corresponding diameter in the flow rate table. This section is used for the selection of flow meter diameter during the design.

7.1 Calculation of liquid flow rate

7.1.1, Measured liquid's volume flow rate Qt

According to the density and maximum flow rate of liquid, put them into equation (1) to calculate the flow rate of water, then find the corresponding diameter and floater code in the flow rate table, and put the flow rate value of the water corresponding to the floater code into equation (1) again to calculate the flow rate of the measured liquid, then the flow rate is rounded to get measured liquid's scale range.

$$Q_S = \sqrt{\frac{(\rho_f - \rho_s)\rho_t}{(\rho_f - \rho_t)\rho_s}} \times Q_t \qquad \text{.....(1)}$$

In which:
Qt: Maximum volumetric flow rate of the measured liquid
Qm: Maximum mass flow rate of the measured liquid
Qs: Flow rate of calibration medium water
ρ_t: Density of floater
ρ_t: Density of the measured liquid
ρ_s: Density of calibration medium water

7.1.2, Measured liquid's mass flow Q_m

The calculation method is the same as above and the formula is based on equation (2)

$$Q_S = \sqrt{\frac{\rho_f - \rho_s}{(\rho_f - \rho_t)\rho_t\rho_s}} \times Q_m \qquad \text{.....(2)}$$

7.1.3, Calculation Example

For a kind of liquid, the operating density is 720 kg/m3, the maximum flow rate is 1800 l/h, calculate the diameter, floater code, and scale range.

Solution: Take the density of the floater as 7850 kg/m3 and the density of water as 1000kg/m3, put 720 (kg/m3) and 1800 (l/h) into formula (1),

Calculate to get $Q_S = \sqrt{\frac{(7850-1000)\times 720}{(7850-720)\times 1000}} \times 1800 = 1497.06$

Check the flow rate table to get: Diameter DN25, floater code: F25.2, Qs=1600, re-put Qs to equation (1), calculate to get Qt=1923.77, after rounding, determine the scale range of the measured liquid: 190～1900 l/h.

7.2 Calculation of Gas Flow Rate

Because the gas is greatly affected by temperature and pressure, its calculation is different from the calculation of liquid. In the flow rate conversion, not only the influence of density but also the influence of temperature and pressure should be taken into account, therefore, when calculating the gas flow rate, it is absolutely necessary to accurately provide the temperature and pressure of the measured gas under working conditions.

7.2.1, If the user gives the gas volume flow rate in the standard state, then calculate according to formula (3):

$$Q_S = \sqrt{\frac{\rho_{st}}{\rho_s} \times \frac{P_s}{P_t} \times \frac{T_t}{T_S}} \times Q_N \qquad \text{.....(3)}$$

7.2.2,If the user gives the gas volume flow in the operating state, then calculate according to formula (4):

$$QS = \sqrt{\frac{\rho_{st}}{\rho_s} \times \frac{P_t}{P_s} \times \frac{T_s}{T_t}} \times Qt \qquad \text{.....(4)}$$

7.2.3,If the user gives gas' mass flow rate, then calculate according to equation (5):

$$Q_S = \sqrt{\frac{1}{\rho_t \times \rho_s}} \times Q_m \qquad \text{.....(5)}$$

In which:

QN: Maximum volumetric flow rate of the gas in the standard state (Nm3/h)

Qt: Maximum volumetric flow rate of the gas in the operating state (m3/h)

Qm: Maximum mass flow rate of gas (kg/h)

Qs: Volumetric flow rate of air in the calibration state(m3/h)

ρ_{st}: Density of gas in the calibration state (kg/m3)

ρ_s: Density of air in the calibrated state (kg/m3)

ρ_t: Density of gas in operating condition (kg/m3)

Ps: Absolute pressure of the air in calibration state (0.1MPa)

Pt: Absolute pressure of the gas in operating condition (MPa)

Ts: Absolute temperature of the air in the calibration state (K)

Tt: Absolute temperature of the gas in the operating condition (K)

7.2.4 Calculation Example

A kind of gas, carbon dioxide, average molecular weight 44, process pressure 0.2 MPa, process temperature 25 ℃, maximum flow rate 48Nm^3/h, please calculate diameter, floater code and scale range.

Solution:

ρ_{st}=1.803kg/m P_t =0.2+0.1=0.3MPa

ρ_s=1.2041kg/m3 T_t =273.15+25=298.15K

Ps=0.1MPa Ts =293.15K Q_N =48Nm3/h

Put the above known conditions into equation (3)

Get $$Q_S = \sqrt{\frac{1.803}{1.204} \times \frac{0.1}{0.3} \times \frac{298.15}{293.15}} \times 48 = 34.2$$

Check the flow rate table to get: Diameter DN25, floater code F25.1, Q_S=35 after rounding. Re-put QS into equation (3) to get Q_N=49.123Nm3/h,

The scale range of the measured medium after rounding is: 4.9 to 49 Nm^3/h.

7.3 Floater Density Tables of Various Materials

Material	CrNi Stainless Steel	PTFE	C4 Hastelloy	Ti Titanium Alloy
Density (t/m3)	7.85	3.4	8.3	2 .1

Note: Standard state: 0℃ (273.15K), 0.1MPa

Calibration state: 20℃ (293.15K), 0.1MPa

7.4 Flow Meter

Vertically installed flow meter (see the following table)

Diameter	Floater code	Water L/h (0.1013MPa abs, 20℃)		Air m3/h (0.1013MPa abs, 20℃)	Pressure loss kPa (Negotiate with the manufacturer if low pressure loss is required)	
	Floater Material	Stainless Steel	PTFE、Ti	Stainless Steel	Stainless Steel	PTFE、Ti
DN15	F15.0	10	-	-	1.5	-
	F15.1	16	-	0.5	1.5	-
	F15.2	25	-	0.7	1.5	-
	F15.3	40	25	1.2	1.5	1.5
	F15.4	60	40	1.8	1.5	1.5
	F15.5	100	60	2.8	1.5	1.5
	F15.6	160	100	4.5	1.5	1.5
	F15.7	250	160	7.5	3.0	1.5
	F15.8	400	250	12	3.0	3.0
	F15.9	600	400	18	3.5	3.0
DN25	F25.0	1000	600	30	1.5	1.5
	F25.1	1200	800	35	1.5	1.5
	F25.2	1600	1000	45	3.0	1.5
	F25.3	2000	1200	60	3.0	1.5
	F25.4	2500	1600	75	3.5	3.0
	F25.5	3000	2000	90	3.5	3.0
	F25.6	4000	2500	120	8.0	3.5
	F25.7	5000	3000	150	8.0	3.5
	F25.8	6000	-	180	16.0	-
DN50	F50.0	6000	4000	180	3.0	3.0
	F50.1	8000	5000	240	3.0	3.0
	F50.2	10000	6000	300	4.0	3.0
	F50.3	12000	8000	360	4.0	3.0
	F50.4	16000	10000	480	8.0	4.0
	F50.5	20000	12000	600	8.0	4.0
DN80	F80.0	25000	16000	750	14.0	8.0
	F80.1	30000	20000	900	14.0	9.0
	F80.2	40000	25000	1200	20.0	12.0
	F80.3	50000	30000	1500	20.0	15.0
DN100	F100.0	60000	40000	1800	28.0	25.0
	F100.1	80000	50000	2400	28.0	27.0
	F100.2	100000	60000	3000	40.0	38.0
DN125	F125.1	100000	80000	3000	45.0	35.0
	F125.2	125000	100000	-	48.0	40.0
DN150	F150.1	125000	100000	-	48.0	40.0
	F150.2	150000	125000	-	50.0	42.5

Horizontally installed flow meter (see the following table)

Diameter	Floater code	Water L/h (0.1013MPa, 20℃)		Air m3/h (0.1013MPa, 20℃)	Pressure loss kPa (要求低压损与厂家协商) (Negotiate with the manufacturer if low pressure loss is required)	
	浮子材料 Floater Material	不锈钢 Stainless Steel	Ti	不锈钢 Stainless Steel	不锈钢 Stainless Steel	Ti
DN15	F15.5	160	100	4.5	1.5	1.5
	F15.6	200	120	6.0	1.5	1.5
	F15.7	250	160	7.5	2.0	2.0
	F15.8	400	250	12	2.0	2.0
	F15.9	600	400	18	3.5	3.5
DN25	F25.0	1000	600	30	1.5	1.5
	F25.1	1600	1000	45	1.5	3.0
	F25.2	2000	1200	60	3.0	3.0
	F25.3	2500	1600	75	3.0	3.5
	F25.4	3000	2000	90	3.5	3.5
	F25.5	4000	2500	120	8.0	8.0
DN50	F50.0	6000	4000	180	3.0	3.0
	F50.1	8000	5000	240	3.0	3.0
	F50.2	10000	6000	300	4.0	4.0
	F50.3	12000	8000	360	4.0	4.0
	F50.4	16000	10000	480	8.0	8.0
DN80	F80.1	25000	16000	750	14.0	14.0
	F80.2	30000	20000	900	14.0	14.0
	F80.3	40000	25000	1200	20.0	22.0
DN100	F100.0	60000	40000	1800	30.0	30.0
	F100.1	80000	50000	2400	30.0	30.0
	F100.2	100000	60000	3000	45.0	45.0
DN125	F125.1	100000	80000	3000	45.0	45.5
	F125.2	125000	100000	-	46.0	48.0
DN150	F150.1	125000	100000	-	48.0	46.0
	F150.2	150000	125000	-	50.0	50.0

Note: The data in the flow meter is the standard parameters of the meter, if the user has special flow range requirements, please consult with the supplier.

8. Flow meter type, flange size and material

Reference table (clamp type) for sanitary flow meter is generally subject to the American standard

DN	Pipe Standard	OD of Pipe	Clamp Size
15	1/2”	φ19	φ50.5
20	3/4”	φ22	φ50.5
25	1”	φ25.4	φ50.5
32	1.1/4”	φ32	φ50.5
40	1.1/2”	φ38	φ50.5
50	2”	φ51	φ64.0
65	2.1/2”	φ63	φ77.5
80	3”	φ76	φ91.0
100	4”	φ101.6	φ119.0

Measuring tube's structure A		Wetted material B		Pipe diameter C			Additional structure D	
1-	Bottom-in and top-out	R0- R1- RP- Ti- RL-	Ocr18Ni12Mo2Ti 1Cr18Ni9Ti PTFE 316L Ocr18Ni12Mo2Ti 1Cr18Ni9Ti PTFE(lined with PTFE) Titanium alloy 316L	Flange type		Sanitary type	No T- Z- G- Y-	Jacket type Damping type High temperature type High pressure type
2-	Top-in and bottom-out			DN15 DN25 DN50 DN80	DN100 DN125 DN150 DN200	K19 K22 K25 K32		
3-	Bottom-in and top side-out					K38 K51 K63 K76 K101		
4-	Bottom side-in and top side-out							
5-	Right-in and left-out							
6-	Left-in and right-out							

E Code combination of indicator for				
M0	Local indicator, square enclosure, mechanical pointer indication of instantaneous flow.			
M1	Powered square enclosure, mechanical pointer indication of instantaneous flow rate, LCD indication of instantaneous/accumulated flow			
M2	Round enclosure, mechanical pointer indication of instantaneous flow rate, LCD indication of instantaneous/accumulated flow is also available			
M3	Square enclosure, mechanical pointer indication of instantaneous flow rate, LCD indication of instantaneous/accumulated flow is also available			
M4	Small stainless steel round enclosure, mechanical pointer indication of instantaneous flow rate			
M5	Small and big stainless steel round enclosure, mechanical pointer indication of instantaneous flow rate, LCD indication of instantaneous/accumulated flow is also available			
	Power supply			
	None	M0 indicator only		
	A	220VAC 50Hz power supply, 4-20mA signal output, backlight is available		
	B	Battery-powered, no signal output		
	C	24VDC two-wire power supply, 4-20mA signal output, without backlight		
	D	24VDC three and four-wire power supply, 4-20mA signal output, backlight is available		
		Explosion-proof marking		
		None	Ordinary non-explosion-proof	
		i	Intrinsically safe Ex ia IICT5 square enclosure	
		d	Flameproof Ex d IIBT4 round enclosure	
			Alarm or pulse output	
			None	Without alarm or pulse output
			K1	Upper limit alarm or one pulse output
			K2	Lower limit alarm or one pulse output
			K3	Upper and lower limit alarm or dual pulse output

* For M0 indicator, if alarm function is selected, the alarming is started by initiator and the corresponding transistor relay.

9, Installation method and considerations of flow meter

Flow meters of different specifications can be selected according to the layout of on-site process piping, of which the vertical installation type is standard type, and all other types are extended types. For example, if the conditions of site permit, the vertical type is preferred. The following schematic diagram can be referred for various installation methods of flow meter.

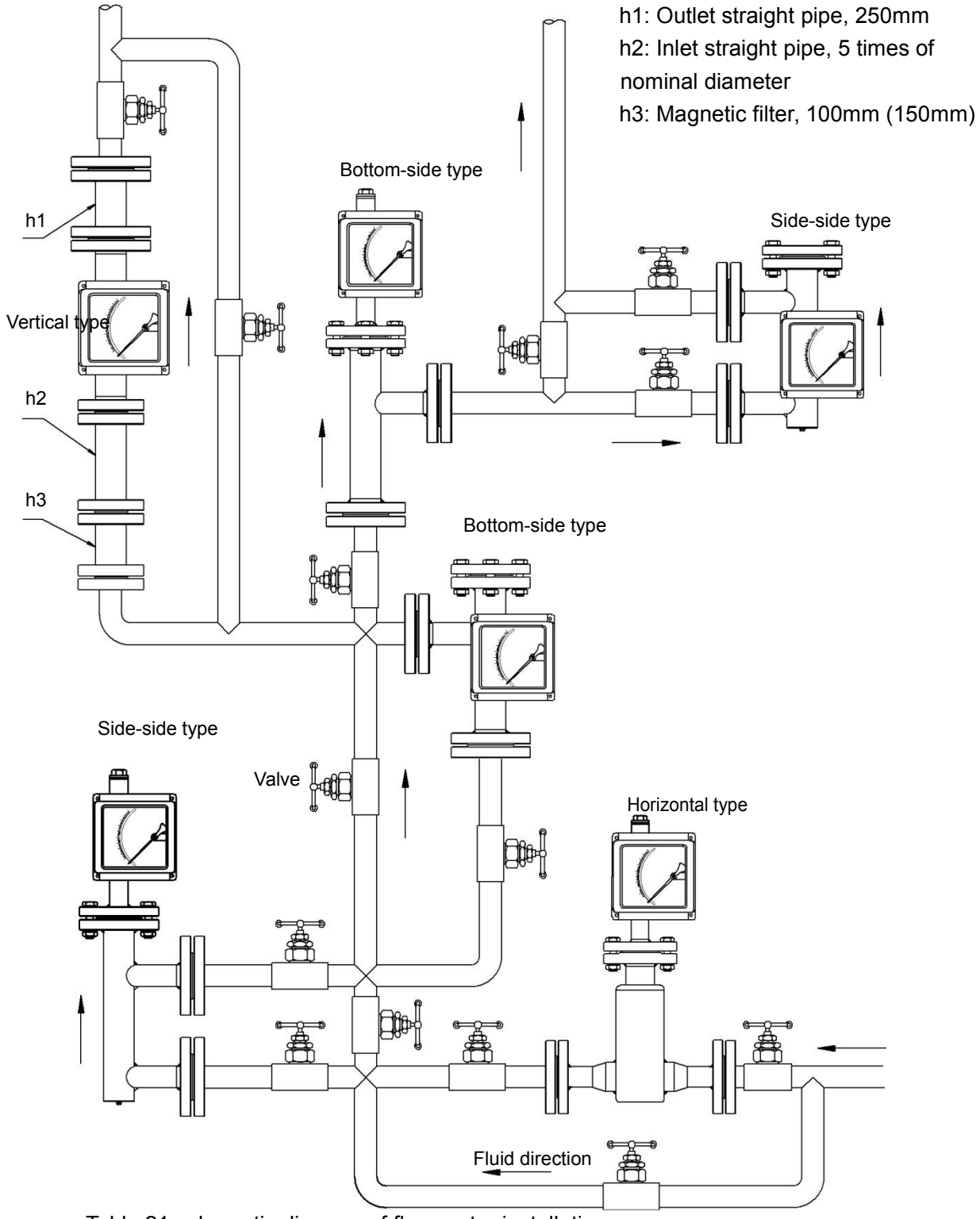


Table 21 schematic diagram of flow meter installation

9.1 Considerations for flow meter Installation

9.1.1. When the meter arrives at the site, before being installed in the process line, it should be unpacked to carefully inspect the meter for any shipping damage.

9.1.2. Prior to installation, the process pipeline shall be purged and cleaned to prevent ferromagnetic impurities in the pipeline from attaching to the floater of the meter, which will affect the normal measurement of the instrument, even damage the meter. If it cannot be avoided, a magnetic filter at the meter inlet should be installed(Figure 17).

9.1.3. Because the instrument's measuring mechanism uses magnetic transfer and magnetoelectric signal processors, in order to ensure the normal use and performance of the instrument, ferromagnetic substances, strong magnetic fields or strong electromagnetic fields are not allowed to exist within at least 500mm of the installation position.

9.1.4. The meter installed in the pipeline shall not be affected by stress; the inlet and outlet of the meter shall have reasonable pipeline support so that the meter will be affected by the least stress from the process pipeline.

9.1.5. The installations of the meter are divided into horizontal installation and vertical installation; for vertically installed instruments, the verticality of the meter should be ensured and the tilt deviation should not exceed 3 degrees; for horizontally installed instruments, the horizontal straightness of the meter should be ensured and the tilt deviation should not be greater than 3 degrees.

9.1.6. When the meter is installed, the diameter of the upstream and downstream pipelines should be the same with the diameter of the instrument, and the connection flanges should be matched with each other; to ensure the measurement accuracy and stability of the instrument, the length of the straight pipe upstream of the meter is 5 times the nominal diameter of the instrument; the minimum length of the downstream straight section is 250mm.

9.1.7. Meters for gas measurement, if the meter discharges gas directly into the atmosphere, it will cause the distortion of meter data and even the damage of instrument. In such working condition, a throttle valve should be installed at the exit of the instrument.

9.1.8. Be careful when installing PTFE-lined instruments. Under low temperature conditions, PTFE will also be deformed under the influence of pressure, therefore, do not arbitrarily tighten the screws, the installation torques are shown in the table below.

mm Diameter mm	kgf.m Maximum torque Kgf.m	Stud bolt
DN15	0.9 ～ 0.95	4×M12
DN25	2.0 ～ 2.2	4×M12
DN50	5.2 ～ 5.6	4×M16
DN80	4.5 ～ 4.8	8×M16
DN100	4.6 ～ 5.0	8×M16
DN125	5.0 ～ 5.3	8×M18
DN150	6.5 ～ 6.8	8×M20

9.2 Meter Maintenance

9.2.1. The meter is a precision device, it must be handled with care in transportation, installation, storage and use; the savage transport, over-stressed installation and indiscriminate placement should be avoided. In all operations, the relative position of the sensor and the indicator must be ensured, and the position change will directly affect the measurement accuracy of the instrument.

9.2.2. In the course of long-term use, ferromagnetic impurities in the pipeline will be inevitably attached on the floater, which will jam the float or affect the measurement accuracy, the floater in the sensor must be cleaned from time to time; if a magnetic filter is installed , it also needs to be regularly cleaned.

9.2.3. The meter indicator is equipped with electronic components in it, after the meter is wired or the enclosure is removed, the screw must be tightened, the sealing performance of the enclosure must be ensured to prevent the entry of impurities, water or other substances, meanwhile, the reliable grounding of meter enclosure must also be ensured.

9.2.4. After the meter is installed, when it is used for the first time, please pay attention to:

When opening the valve, in order to avoid the floater crashing the limit device and causing damage to the meter by formed pressure shocks. Be sure to open the valve slowly!

Instruments for measuring gas are equipped with a gas damper to minimize the oscillation of the floater; to ensure the stability of the floater, a throttle valve can be installed at the outlet of the instrument.

9.2.5. For remote-type instruments, it is necessary to ensure that the instrument's wiring is properly connected before it is powered; for hazardous applications, explosion-proof type must be selected and installed in accordance with the explosion-proof requirements.

10, Electrical connections

This chapter mainly introduces the power supply wiring of the flow meter, the connection with the safety barrier, and the technical parameters of the safety barrier.

10.1. Power wiring of flow meter

First, unscrew the front cover. if it is a square enclosure, you can see the terminals on the base, of which, the terminal that connects the red lead connects to the positive pole of the power supply; and the terminal that connects the black lead connects to the negative pole of the power supply. If it is the round enclosure, you can see the terminals on the circuit board and connect the power cable according to the marking. The flameproof type should be grounded internally. The flow meter is a 2-wire 4-20mA output. See Figure 22.

10.2. Intrinsically safe associated equipment

Metal tube float flow meter must be intrinsically safe or flameproof when used in hazardous locations. When intrinsically safe explosion-proof type is selected, associated equipment—safety barriers shall be configured to constitute an intrinsically safe explosion-proof system. The safety barrier is divided into Zener type and isolated type.

10.2.1 Technical Parameters of Zener Barrier

Explosion-proof mark: [Exia] II C

Maximum allowable voltage: 250VAC/DC

Rated parameters of intrinsically safe circuit: UO ≤ 28V, IO ≤ 119mA, CO ≤ 0.083μF, LO ≤ 2.5mH

Installation location: Safe area

Environmental conditions: Continuous using temperature: -10℃～ 45℃

Storage temperature: -40℃～ 80℃

Relative humidity: 5-95%RH

10.2.2 Technical Parameters of Isolated Barrier

Basic tolerance: ±0.2%F·S

Explosion-proof marking: [Exia] II C

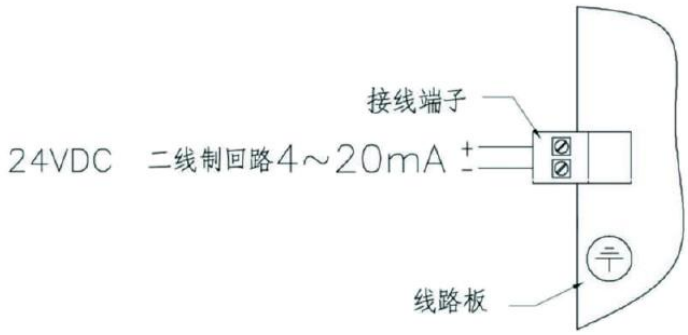
Rated parameters of intrinsically safe circuit: UO ≤ 30VDC, IO ≤ 30mADC

Output load: 0-500Ω

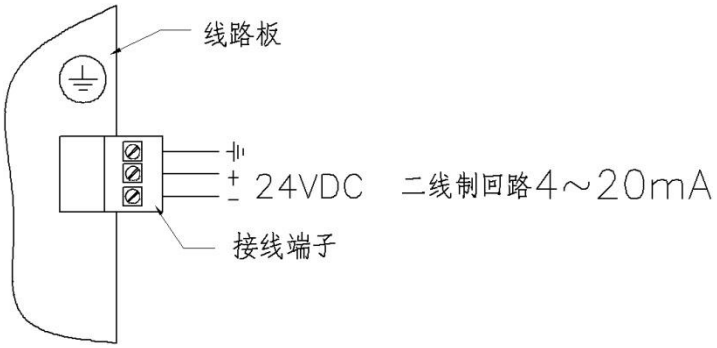
Power Supply: 24VDC

10.2.3 Connection of flow meter and Barrier

This manual uses the TSA528.H type Zener barrier and the SFA-1100/k type barrier as an example to illustrate the connection method between the safety barrier and the flow meter. Other types of safety barriers are subject to their instructions for use. See the figure below.



Square Enclosure



Round Enclosure

Figure 22 Wiring diagram of flow meter’s power supply

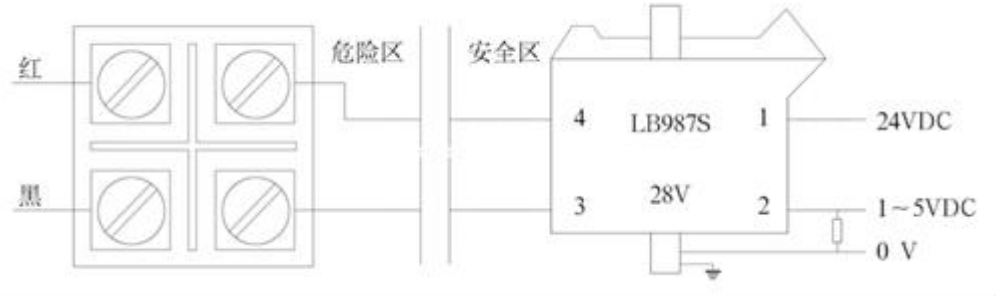


Figure 23 Wiring diagram of flow meter and Zener Barrier

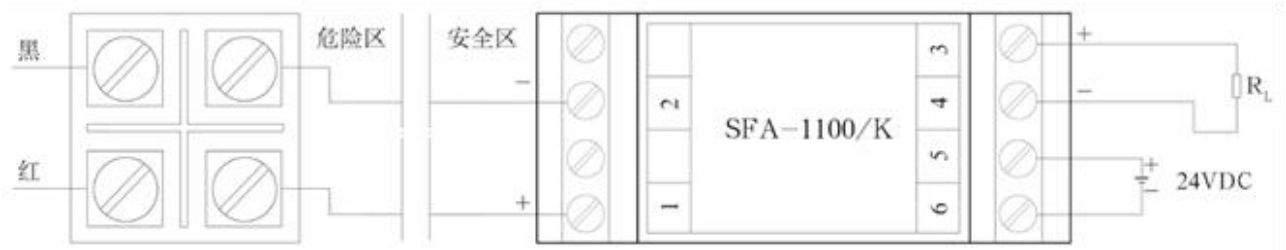


Figure 24 Connection between flow meter and isolated safety barrier

11, Operation method of 11 M1, M2, M5 indications (Square and round enclosures)

The intelligent indicator directly displays the instantaneous flow and accumulated flow rate of the fluid through the LCD screen. The internal parameters of the meter can also be viewed using the 4 keys on the panel, and some of the parameters can be reset to realize the calibration function.

11.1 Key Functions

Description of keys' function:

→ Key: Move the cursor rightward and skip to the next item

←┘ Key: Save data, exit

+ Key: increase the value at the cursor 1, switch the display

- Key: Decrease the value at the cursor 1, switch the display

←┘ and → keys: Forced quit

11.2 Methods for Entering Each Group of Meter Parameters

Operation A:

1. Unit setting

When the unit is flashing, the display unit can be switched by pressing the +/- key, and the unit display will be switched as follows by pressing + key; the unit display will be switched reversely by pressing - key.

m^3/H→T/H→L/H→KG/H→N m^3/H→H m^3/H→G/H→KG/MIN→M^3/MIN→L/MIN

2. Decimal point of displayed PV value

Switch the decimal point value between PIONTO → PIONT1 → PIONT2 → PIONT3 by +/- keys

3. After one minute without any operation, exit to the normal display state

Operation B:

When the up arrow is flashing, you can press the → key to move the cursor rightward, when the cursor is in the value position: set the value with the +/- key; when the cursor is in the decimal point position: Press the enter key to confirm the decimal point, the cursor moves rightward to the value position after the decimal point.

After the value is determined, press ←┘ to save, if you do not want to save, then press the ←┘ and → keys at the same time for 1s and exit to the next item. Press ←┘ and → key for 3s at the same time and exit to normal display. After one minute without any operation, it exits to the normal display state. Manufacturer's calibration process: it exits to normal display after two minutes without any operation.

Operation C:

The upper and lower limits of the alarm can be negative numbers, the upper arrow represents positive number, and the minus sign represents negative number. When the up arrow or minus sign is flashing, the positive and negative numbers can be switched by the +/- keys. After confirming the positive and negative values, you can press the → key to move the cursor rightward and set the value. When the cursor is in the value position: Set the value with the +/- keys; when the cursor is in the decimal point: Press the enter key to confirm the decimal point, and the cursor moves rightward to the value position after decimal point.

After the value is confirmed, press ← to save. If you do not want to save, press the ← and → keys at the same time for 1s and exit to the next item. Press ←┘ and → key for 3s and exit to normal display. After one minute without any operation, it exits to the normal display state.

Operation D:

Instructions for manufacturer's calibration: When the upper and lower limits of the main variable range and the number of calibration points N are determined, the calibration flow rate value is evenly distributed according to the number of calibration points. Immediately after entering each calibration state (the last digit on the right flashes), press the ←┘ key at this time, the evenly distributed flow value and the angle value at the bottom of the LCD are stored as a set of calibration values, and then each point is sequentially completed by the similar method until the last point of the calibration value is saved, and by this point one calibration is completed; if you want to set the flow value on yourself, move the cursor rightward by pressing → key. The setting method is the same as the operation B.

After the value is confirmed, press ←┘ to save. If you do not want to save, then press ←┘ and → keys for 1s at the same time and exit to the next point calibration. Press the ←┘ and → keys for 3s at the same time to exit to the normal display. After two minutes without any operation, it will exit to the normal display state.

For different decimal digits, the examples of operation instructions for setting ranges and calibration values are as follows:

1. When the number of decimal digit is 0 (PIONTO): The cursor's right moving operation is performed only among the six digits of data, decimal number can't be set.

2. When the number of decimal digit is 1 (PIONTI): When the cursor moves rightward to the first digit, the second digit flashes at the same time, the cursor moves rightward to the decimal point, the data will not be changed, if the decimal point is determined, the data is the first digit after the decimal point. The cursor is the same for other digits.

2. When the number of decimal digits is 2 (PIONT2): When the cursor moves rightward to the first digit of the data, the second and third digits of data start flashes at the same time, cursor will move rightward to the decimal point, and data will not be changed, if the decimal point is determined, the data is the two digits after decimal point. The cursor is the same for other digits.

2. When the number of decimal digits is 3 (PIONT3): When the cursor moves rightward to the first digit, the second, third and fourth digits of the data start flashing at the same time, the cursor will move rightward to the decimal point, and the data will not be changed, if the decimal point is determined, the data is the three digits after decimal point. The cursor is the same in other digits.

11.3 Configuration Password

Password for configuration setting 00

Password for on-site manufacturer calibration 22

Password for zero setting of host variable 11

Password for zero setting of accumulated flow rate 33

Password for data backup 44

Password for data recovery 55

Browsing configuration data →

Display switching ←┘

12, Use method and operation of model M3 indicator (Square enclosure)

The on-site adjustment of the meter is completed through the cooperation of keys and LCD display. The keys are divided into two keys, namely: SPAN and ZERO.

The on-site adjustment of the meter can achieve the following functions: switching LCD display, browsing the configuration data, setting the main variable unit, setting the upper and lower limits of the main variables' ranges, the upper and lower limits of alarm, the damping value of the main variables, zero setting of the accumulated flow rate and zero setting of the main variables.

The on-site adjustment methods of the meter are shown as follows.

12.1 Switching the Meter _ Display

In the normal working condition of the instrument, the meter displays according to the configuration data. After pressing the SPAN key, the meter displays a cyclical switching among "Current → Percentage → Main Variable", when the variable desired for setting is displayed, the key is released and the display variable is successfully set.

12.2 Viewing Configuration Data

When the meter is working normally, press ZERO key for 5 seconds to enter the "browsing configuration data" mode.

After entering the configuration data mode, press the ZERQ key. The meter display a cyclical switching among "Unit → Upper Limit of Range → Lower Limit of Range → Upper Alarming limit → Lower Alarming limit → Damping → Parameters of Measured Medium→ Normal Display".

If the meter displays configuration data, it will return to normal display without key operation within 1 minute.

12.3 Configuration Setting

When the meter displays normally, press the SPAN key and the ZERO key for 5 seconds at the same time to enter the password setting state of the instrument, the password for configuration data setting is 0000, if the password is correct, enter the setting state of the configuration data; or it will return to the normal display. Instrument's configuration adjustment flow chart is shown in Figure 1:

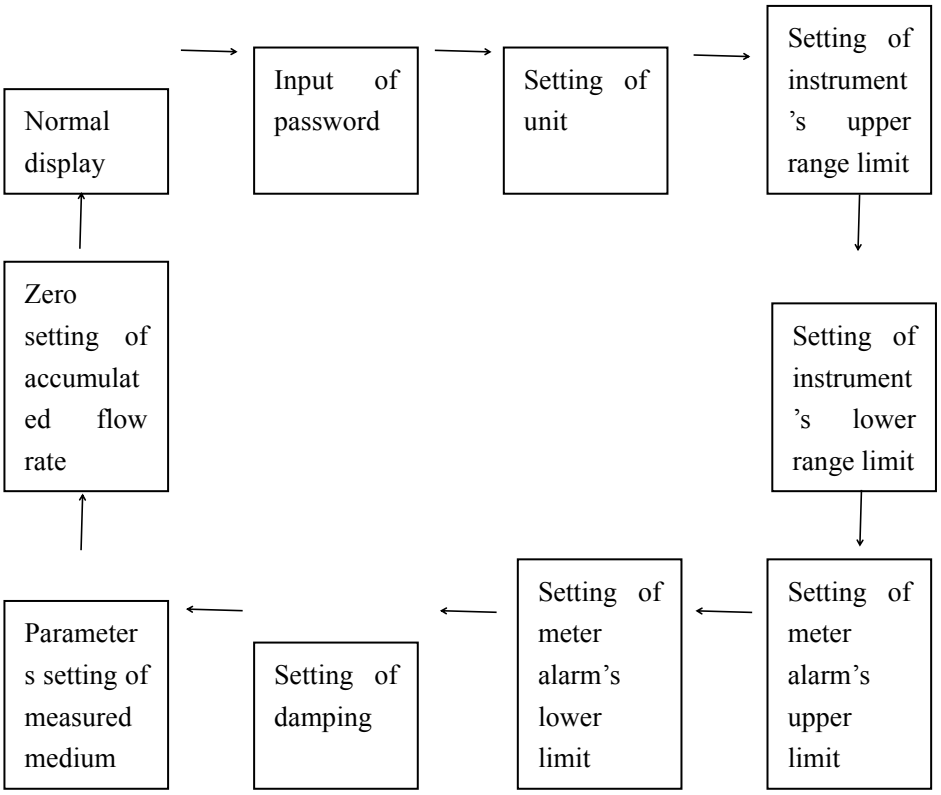


Figure 1

- **Setting of password**

When the floater flow meter displays normally, press the SPAN key and the ZERO key at the same time for 5 seconds. The meter displays the following:

Figure 2 password input state

At this time, the meter is in the password input state, the leftmost digit begins to flash, which indicates that the password can be set; press the SPAN key to increase the value of the flashing digit; press the ZERO key to make the flashing digit move rightward, when switching to the arrow at the bottom left of the LCD, press SPAN key, the password setting is completed. If the password is set correctly, it will enter the prompt to modify the state of the main variable units, the meter displays as shown in Figure 3; or it will return to the normal display state.

- **Setting the main variable units**

After entering the prompt to modify the main variable units, press the ZERO key to skip the modification of the main variable units, it directly enters the prompt to modify the upper limit of the range (see Figure 5). Press the SPAN key to enter the modification state of main variable unit, the current main variable units will be displayed at the bottom of the LCD (see Figure 3), which means that the main variable unit is modifiable; when the SPAN key is pressed, the main variable unit will be changed according to the sequence of "$m^3/H \rightarrow T/H \rightarrow L/H \rightarrow KG/H \rightarrow Nm^3/H \rightarrow Hm^3/H \rightarrow G/H \rightarrow KG/MIN \rightarrow M^3/MIN \rightarrow L/MIN$" (assuming the unit of the current main variable is m^3/H), and the modifiable state of the main variable unit is indicated by flashing; after pressing the ZERO key, the modification state of the main variable will be exited and the currently displayed unit is set as the current main variable unit, after the setting is successfully completed, the prompt indicates that the setting is successful, the meter displays as shown in Figure 4. 1 second later, the meter enters the prompt to modify the upper limit of the measurement range. The meter displays as shown in Figure 5.

Figure 3 Modification state of the main variable units

Figure 4 Prompt for successful setting

- **Setting the upper limit of the range**

After the system enters the prompt state to modify the upper range limit, the current upper range limit will be displayed on the LCD (see Figure 5, the unit is the current setting of the instrument).

Figure 5 Modifying the upper limit of the range

The meter is in the prompt to modify the upper limit of the range, if the ZERO key is pressed, the modification of upper range limit will be skipped, and it will be switched to the prompt to modify the lower range limit (see Figure 6); if the SPAN key is pressed, it will enter the modification state of upper range limit. At this time, the arrow at the bottom left of LCD starts flashing (for negative number, the minus sign starts flashing), which means that the upper limit of the range can be modified; if you have entered the modification state of range's upper limit, press the SPAN key to set the ±sign (the flashing arrow at the bottom left of LCD represents the positive number; the flashing negative sign in the left represents negative number) or set decimal point or increase the value of flashing digit; press ZERO key to make flashing digit shift rightward; when switching to the arrow at the bottom left of LCD, press ZERO key to continue to modify the upper limit of range; press SPAN key, the meter directly skips to the prompt to modify the lower limit of the measurement range, the meter displays as shown in Figure 6.

- **Setting the lower limit of the measurement range**

After the system enters the prompt to modify the lower limit of the measurement range, the lower limit of the current range will be displayed on the LCD (see Figure 6, the unit is the current setting of the meter).

Figure 6 modifying the lower limit of the range

The meter is in the prompt for modification of lower range limit, If the ZERO key is pressed, the modification of lower range limit will be skipped; if the SPAN key is pressed, it will enter the state for modification of lower range limit, at this time, the minus starts flashing, which means that the lower limit of the range is modifiable, its operation is the same as the modification of upper range limit. Press the ZERO key to make the number to be changed flashing. Press the SPAN key to change the flashing digit or set the decimal point. After the modification is completed, press the SPAN key, if the upper and lower limits of the meter meet the requirements (including the upper limit range, lower limit range and minimum range), the upper and lower limits of the range will be stored in the instrument. If the set upper and lower limit values do not meet the requirements, the over-limit setting will be prompted and the meter displays as shown in Figure 7. At this time, it will return to the prompt to modify the upper limit of the measurement range by pressing any key. After the range’s upper and lower limits are set successfully, it will prompt the successful setting. The meter displays as shown in Figure 4. 1 second latter, the meter enters the prompt to modify the upper limit of the alarm, and the meter displays as shown in Figure 8.

Figure 7 prompt for setting of over-limit

- **Setting the upper alarming limit**

After the system enters the prompt to modify the upper limit of the alarming, the current upper limit of the alarm will be displayed on the LCD (see figure 8, the unit is %):

Figure 8 state of modifying the upper limit of the alarm

The meter is in the prompt to modify the upper limit of alarming, if the ZERO key is pressed, the modification of the upper warning limit will be skipped, it will be directly switched to the prompt for the modification of the lower warning limit (see figure 9). If the SPAN key is pressed, then it enters the state for modifying the upper warning limit. The first digit starts flashing, which indicates that the upper limit of the alarm can be modified; press the ZERO key to make the digits to be changed flash; press the SPAN key to change the flashing digit or set the decimal point and symbols. When switching to the arrow at the bottom left of the LCD, press the ZERO key, the modification is completed, and the upper alarming limit will be stored in the meter, which indicates that the setting is successfully completed and the meter displays as shown in Figure 4. 1 second later, the meter enters the prompt state to modify the lower warning limit, and the meter displays as shown in Figure 9.

- **Setting the lower alarming limit**

After the system enters the prompt to modify the lower limit state of the alarm, the lower limit of the current alarm will be displayed on the LCD (see Figure 9, the unit is %):

Figure 9 state of modifying the lower limit of the alarm

The meter is in the prompt to modify the lower limit of alarming limit, if the ZERO key is pressed, the modification of the lower warning limit will be skipped; it will be directly switched to the prompt for the modification of damping. If the SPAN key is pressed, then it enters the state for modifying the lower warning limit, the first digit starts flashing, which indicates that the lower limit of the alarm can be modified; press the ZERO key to make the digits to be changed flash; press the SPAN key to change the flashing digit or set the decimal point and sign. When switching to the arrow at the bottom left of the LCD, press the ZERO key, the modification is completed, and the lower alarming limit will be stored in the meter, which indicates that the setting is successfully completed and the meter displays as shown in Figure 4. 1 second later, the meter enters the prompt state to modify the damping.

- **Setting of the damping**

After the system enters the prompt to modify the damping time state, the current damping time will be displayed on the LCD (see Figure 10, unit is second):

Figure 10 state of modifying the damping time

The meter is in the prompt state to modify the damping time, if the ZERO key is pressed, it will skip the modification of the damping time and enter the prompt to modify the parameter of the measured medium; press the SPAN key, then it enters the state of modifying the damping time, the first digit starts flashing, which indicates that the damping time can be modified; press the ZERO key to make the digit to be changed flash, press the SPAN key to change the flashing digit or set the decimal point (the damping time can't be negative). When switching to the arrow at the bottom left of the LCD, press the ZERO key and the change is completed. If the meter's damping time meets the requirement (less than or equal to 32 seconds), the damping time will be stored in the meter. If the set damping time does not meet the requirements, meter will prompt the over-limit setting. The meter will display as shown in Figure 7. Press any key at this time, it returns to the prompt to modify the damping time. After the damping time is set successfully, the setting is successfully completed and the meter displays as shown in Figure 4. 1 second later, it enters the prompt state to modify the parameters of measured medium.

Note: The backup data can be restored to the EEPROM by successively setting the damping values to be 4567 and 5678. When performing this operation, be sure to confirm that the EEPROM data backup has been performed before leaving the factory.

During the process of backing up the EEPROM data and restoring the backup data to the EEPROM, the LCD displays as shown in Figure 11:

Figure 11 Prompt for Backup or Restoring Data to EEPROM

- **Set the parameters of measured medium**

Do not modify the parameters of the measured medium, including the state, density, temperature, pressure and all other parameters of gas and liquid. Please directly press the ZERO key to skip this setting and enter the zero setting of accumulated flow rate.

Zero setting of accumulated flow rate

After the system enters the prompt for zero setting of accumulated flow rate, the LCD displays as shown in Figure 13:

Figure 13 Prompt interface for zero setting of accumulated flow rate

Figure 14 YES prompt interface

Figure 15 NO prompt interface

When the meter is in the prompt state for the zero setting state of accumulated flow rate, if the ZERO key is pressed, the zero setting of accumulated flow rate will be skipped and it returns to the normal display state; if the SPAN key is pressed, then it enters the zero setting of accumulated flow rate, and the LCD alternately displays “YES → NO”as shown in Fig. 14 and Fig. 15; when the LCD displays “YES”, press ZERO key for the zero setting of accumulated flow rate, after the successful operation, the meter displays as shown in Fig. 4. 1 second later, it returns to the normal display. When the LCD shows “NO”, press the ZERO key and return to the normal display.

- **Zero setting of main variables**

When the meter displays normally, press the SPAN key and the ZERO key for 5 seconds at the same time to enter the password setting state of the instrument, the password for the zero setting of the main variables is 1111, if the password is correct, it will enter the prompt for the zero setting of main variables, or it will return to normal display.

After the system enters the zero setting state of the main variables, the display is shown in Figure 16.

Figure 16 Zero setting of the main variables

When the meter is in the prompt for the zero setting state of main variables, if the ZERO key is pressed, the zero setting of main variables will be skipped and the display returns to the normal display state; if the SPAN key is pressed, it enters the zero setting of the main variables, and the LCD alternately displays “YES → NO”as shown in Fig. 14 and Fig. 15; when the LCD displays “YES”, press ZERO key for the zero setting of main variables, after the successful operation, the meter displays as shown in Fig. 4. 1 second later, it returns to the normal display. When the LCD shows “NO”, press the ZERO key and return to the normal display.

- **Simple zero setting of flow rate by user**

XF3 is the extension socket for the long-distance MODE switch, the two wires of the socket are soldered on a toggle switch, after the switch is turned on for 5 seconds, and the zero setting of accumulated flow rate can be realized. If the zero setting of accumulated flow is not required, turn the toggle switch to the off position. Switch should be prepared by user himself.

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